

## REMARKS

### Present Status of the Application

Claims 1-11 and 36-43 were previously pending, of which claims 1-11 have been canceled without prejudice or disclaimer and claim 36 has been amended. New claims 44-52 have been added to more fully protect the invention. It is believed that no new matter adds by way of these amendments made to the claims or specification or otherwise to the application. For at least the following reasons, Applicant respectfully submits that all remaining claims 36-52 are in proper condition for allowance. Reconsideration is respectfully requested.

### Response to Rejections under 35 U. S. C. 112

1. The Office Action rejected claims 1-11 and 36-43 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In rejecting the above claims, the Office Action pointed out that claim 1 recites the limitation "the bonding pad and the chip" in line 3. Claim 36 recites the limitation "the solder mask" in line 8. There is insufficient antecedent basis for this limitation in the claim.

Applicant has canceled claim 1 and amended claim 36. After entry of the foregoing amendment to claims, it is believed that the above rejection can be overcome. Reconsideration is respectfully requested.

### Response to Rejections under 35 U. S. C. 102

2. The Office Action rejected claims 1, 2, 4, 5, 7, 8, 36, 37, 39, and 40 under 35 U.S.C. 102(b) as being anticipated by Yamai et al. (JP-409045691, hereinafter Yamai).

Applicants respectfully disagree and traverse the above rejections as set forth below. Independent claim 36 is not anticipated and is allowable for at least the reason that Yamai fails to teach, suggest or disclose each and every features of the claimed invention. More specifically, Yamai fails to teach, suggest or disclose at least "a cylindrical solder cap on the conductive cylinder, wherein the cylindrical solder cap has an outer diameter smaller than the diameter of the opening in the patterned solder mask and a length greater than the depth of the opening, and the solder material has a melting point lower than the conductive cylinder material, as

required by claim 36." The technical impact of the above structure is that, because the outer diameter of the cylindrical solder cap is smaller than the diameter of the opening in the patterned solder mask, the entrance of the cylindrical solder cap is ensured so that the electrical connection between the cylindrical solder cap and the junction pad of the chip; and because the cylindrical solder cap has a length greater than the depth of the opening in the patterned solder mask, full contact of the cylindrical solder cap and the junction pad of the substrate is assured. Therefore the both the reliability of the device and the manufacture yield can be effectively promoted.

Yamai teaches a structure comprising a first bump 10 and a second bump 11 covering the first bump 10, wherein the melting point of the material of the second bump 11 is lower than that of the material of the first solder bump 10. However, there is no disclosure in Yamai's patent teaching or suggesting that the outer diameter of the second bump 11 is smaller than the opening of a patterned solder mask on a substrate to be attached to and that the length of the second bump 11 is greater than the depth of the patterned solder mask. Indeed, Yamai fails to teach a patterned solder mask with an opening formed on a substrate, into the opening the second bump 11 is inserted. Accordingly, Applicants respectfully submit that Yamai cannot anticipate claim 36.

Claim 37, 39, and 40 depend from claim 36 and, therefore, are not anticipated either for at least the same reasons as claim 36.

Withdrawal of the rejection is requested.

3. *The Office Action rejected claims 1 and 9 under 35 U.S.C. 102(b) as being anticipated by Anonymous et al. (JP-291011, hereinafter Anonymous).*

Applicants have canceled claims 1-11. The rejection is now moot.

**Response to Rejections under 35 U. S. C. 103**

4. *The Office Action rejected claims 3 and 38 under 35 U.S.C. 103(a) as being unpatentable over Yamai as applied to claims 1 and 36 and in further combination with Baba et al. (US-6,016,013, hereinafter Baba).*

*In rejecting the above claims, the Office Action asserted that Yamai does not disclose that the pad is formed in redistribution circuit layer, however, Baba utilizes a redistribution circuit layer by extending original pad (9) to another location on chip pad 13. It would have been*

*obvious to one skilled in the art to modify the pad structure of Yamai by incorporating a redistribution circuit layer in order to further improve the reliability of the connection made by the metal bumps as taught by Baba.*

The Office Action relied upon Baba to disclose the redistribution circuit layer, however, Baba cannot cure the specific deficiencies of Yamai as discussed in paragraph 2 above. Thus, claim 36 as well as its dependent claim 38 is patentable over Yamai and Baba.

Reconsideration and withdrawal of the rejection to claim 38 is respectfully requested.

Claim 3 has been canceled. Thus, the rejection to claim 3 is now moot.

5. *The Office Action rejected claim 6 under 35 U.S.C. 103(a) as being unpatentable over Yamai as applied to claim 5 and in further combination with Tago et al. (US-5,508,561, hereinafter Tago).*

*In rejecting the above claim, The Office Action asserted that Yamai does not appear to disclose that solder cap has an outer diameter smaller than the conductive cylinder. However, Tago utilizes a solder cap with an outer diameter smaller than the conductive cylinder. It would have been obvious to one skilled in the art to modify the solder cap of Yamai by making it smaller outer diameter than the conductive cylinder, in order to short circuits with adjacent pads as taught by Tago (col. 10, lines 13-17).*

Applicants have canceled claim 6 without prejudice or disclaimer. The rejection is now moot.

6. *The Office Action rejected claims 10, 11, 42 and 43 under 35 U.S.C. 103(a) as being unpatentable over Yamai as applied to claims 1 and 36 and in further combination with Chiu et al. (US-5,641,990, hereinafter Chiu).*

*In rejecting the above claims, the Office Action asserted that Yamai does not appear to disclose a transition layer comprising at least one conductive layer between the cylinder and conductive block. However, Chiu utilizes a conductive transition layer (col. 6, lines 1-3) comprising at least on conductive layer between the cylinder and the conductive block. It would have been obvious to one skilled in the art to incorporate a conductive transition layer between*

*the cylinder and the block in order to prevent a collapse of the cylinder manufacture as taught by Chiu (col. 6, lines 10-14).*

The Office Action relied upon Chiu to disclose the transition layer. However, Chiu cannot cure the specific deficiencies of Yamai as discussed in paragraph 2 above. Therefore, claims 36 as well as its dependent claims 42 and 43.

Reconsideration and withdrawal of the rejection to claim 42 and 43 is respectfully requested.

Claims 10 and 11 have been canceled. Thus, the rejection to claims 10 and 11 is now moot.

*7. The Office Action rejected claim 41 under 35 U.S.C. 103(a) as being unpatentable over Yamai.*

*In rejecting claim 41, the Office Action asserted that Yamai discloses the elements stated in paragraph 7, but do not show a ball contact metallic layer between the conductive cylinder and the bonding pad. It would have been obvious to one skilled in the art at the time of the invention to form the contact metallic ball layer between the conductive cylinder and the bonding pad, since it has been held that mere rearranging parts of an invention involves only routine skill in the art.*

For reasons discussed in paragraph 2 above, claim 36 is patentable over Yamai. Claim 41 depends from claim 36 and, thus, is also patentable over Yamai for at least the same reasons as claim 36.

Reconsideration and withdrawal of the rejection is respectfully requested.

#### New Claims

Newly added independent claim 44 contains elements similar to that of claim 36. Claim 44 is believe patentable for similar reasons.

Newly added claims 45-51 dependent from claim 44 are also patentable over the cited prior art for the same reasons as claim 44.

Independent claim 52 further recites "a transition layer on the conductive cylinder; and a solder block on the transition layer, wherein the transition layer comprises a non-corrosive material." None of the cited references teaches or suggests such features. The advantage of disposing the transition layer is that it not only promotes the connectivity between the conductive cylinder and the solder block but also effectively prevent the collapsing of the solder block material onto the peripheral section of the conductive cylinder due to short circuit between the neighboring conductive cylinders during the reflow process. Thus the reliability of the device can be effectively promoted. Claim 52 is believed patentable over the prior art.

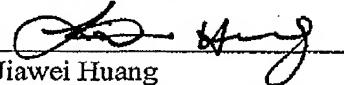
### CONCLUSION

For at least the foregoing reasons, it is believed that all pending claims 36-52 are in proper condition for allowance. If the Examiner believes that a conference would be of value in expediting the prosecution of this application, he is cordially invited to telephone the undersigned counsel to arrange for such a conference.

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**Version with markings to show changes made**

**In The Claims**

Claims 1-11 have been canceled without prejudice or disclaimer.

Claim 36 has been amended as follows:

36. (Amended) A cylindrical bonding structure on a silicon chip such that the structure may flip over and connect with a substrate, wherein the chip has at least one bonding pad and the substrate has a substrate surface having a patterned solder mask and at least one junction pad thereon, and the patterned solder mask layer has at least an opening that exposes the junction pad, the cylindrical bonding structure comprising:

a conductive cylinder on the bonding pad of the chip; and

a cylindrical solder cap on the conductive cylinder, wherein the cylindrical solder cap has an outer diameter smaller than the diameter of the opening in the patterned solder mask and a length greater than the depth of the opening, and the solder material has a melting point lower than the conductive cylinder material.

New claims 44-52 have been added.

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